REMARKS

Claims 15 through 29 are pending in the application. Claims 12-14 are canceled without prejudice or disclaimer. Claim 15 is withdrawn. New claims 16 through 34 are added. The Specification has been amended to conform to the amendments to Figures 1A, 5A, and 7A with respect to the designation of the cross-sectional lines.

These changes are believed not to introduce new matter, and entry of the Amendment is respectfully requested.

Based on the above Amendment, the new claims and the following Remarks, Applicant respectfully requests that the Examiner allow all of the newly submitted claims and pass this application to issue.

CLAIM TO PRIORITY

In paragraph 3 of the Office Action, the Examiner indicated that a cross-reference to the parent application should be entered as the first sentence of the application. It is respectfully pointed out that page 2 of the Transmittal Letter for this application, submitted November 2, 2001, already includes the following request to amend the specification:

Amend the specification by inserting before the first line the sentence:

This is a Divisional of Application Serial No. 09/417,662 filed October 14, 1999

and issued as U.S. Patent No. 6,392,164 on 21 May 2002.

It is therefore respectfully requested that the previously requested Amendment be entered, and it is submitted that further amendment of the Specification is not necessary.

OBJECTIONS TO THE DRAWINGS

In paragraph 4 of the Office Action, the drawings were objected to as not including reference numeral 140 corresponding to ground 140 described in the specification. This objection is overcome by the amendment of Figures 1A, 5A, 6A, 6B, 6C, 7A, 9 and 11 to incorporate reference numeral 140.

OBJECTS AND ADVANTAGES OF THE INVENTION

It is the object of the present invention to achieve a high density and low-cost signal-line connection in which the reflection of signals, which is due to differences in characteristic impedances of signal interconnect layers and signal-line connection members, is small so as to achieve both, stabilization of characteristic impedance and a high density mounting. Achievement of this object is as recited in the claims, and it is a particularly characteristic feature that it employs a substantially circular intermediate connection layer 106, sandwiched between the connection members 103, and electrically connects the connection members 103 with a shield layer 107, being provided in approximately the same plane as the intermediate connection layer 106 and surroundingly spaced from and around the intermediate connection layer.

Due to the above-described arrangement, it is possible to provide a plurality of intermediate grounding layers within the substrate in the multi-level circuit substrate according to the present invention, the peculiar effect of enabling signal connection members to be formed in a density of twice or more per each unit area than was possible in conventional devices.

PRIOR REJECTIONS UNDER 35 U.S.C. § 103

All of the original claims 1 through 14 were rejected on Young U.S. Patent No. 5,408,053 or upon Young in view of Hayashi U.S. Patent No. 5,406,235. It is Applicant's position that Young does not disclose the conditions recited in the last paragraph of original claim 1 or achieve the above described objects achieved by the parent invention and the disclosure of Young is wholly inadequate to support reliance upon Young in a similar rejection of the newly submitted claims 16 through 34 provided herein.

Attention is respectfully invited to attached Exhibit A that comprises a perspective view of the device of Young more clearly illustrating the Young structure than does the patent drawings. A significant aspect of the Young device is the employment of interconnection layers 11 which extend all the way across the full width of the Young device from one side to the other of the substrate as evidenced by Figure 2 of Young. On the other hand, the interconnect layers 102 and 112 of the present invention extend inwardly from opposite sides of the apparatus and have an inward termination inside the substrate structure as best shown in Figures 1A and 1B.

Section 9 of the Office Action in rejecting original claim 1 suggests that column 3, lines 1 through 11 of Young indicates that the interconnection layer "may have different shapes", a statement which does not constitute a teaching of any specific different shape. Moreover, a careful reading of column 3, lines 1 through 11 of Young contemplates nothing more than the conductive strips 11 possibly being "of non-uniform widths". Clearly, Young does not teach the upper and lower non-aligned interconnect layers and their specific shapes, such as that required for them to have an end termination at a central location in the substrate, as recited in new claim 16.

Yet another difference between Young and the present invention as defined in new claim 16 resides in the fact that in Young connection members 15 are connected to the lengthwise extending conducting strips 11 at a plurality of positions, none of which constitutes an end termination as recited in new claim 16.

More specifically, new claim 16 is directed to a multi-level circuit substrate with the claim clearly distinguishing over Young in reciting upper and lower parallel non-aligned interconnect layers respectively extending inwardly horizontal from opposite sides of the substrate and having an end termination at a central location in the substrate. Claim 16 further distinguishes over Young in reciting two aligned conductors each respectively extending perpendicularly from one of the interconnect layers and having an inner end centrally of the substrate. Moreover, claim 16 also additionally provides a further distinction over Young in reciting an intermediate connection layer (layer 106) sandwiched between and in contact with the inner ends of the aligned conductors so as to provide an electrical connection between the upper and lower non-aligned interconnect layers. Further distinction over Young is provided by the recitation of the shield layer provided in approximately the same plane as the intermediate connection layer and surroundingly spaced from and around the intermediate connection layer. Clearly, Young does not teach or suggest a shield layer related to an intermediate connection layer in the manner recited in claim 16.

An even more dramatic and compelling distinction of new claim 16 over Young is provided by the last paragraph of claim 16 which reads:

> wherein a condition of $(R \cdot r) / (2 \cdot h) \leq L \leq (5 \cdot R \cdot r) / h$ is satisfied, provided that a connection distance between the interconnect layers through the aligned conductors and the intermediate connection layer is h, the aligned conductors are circular cylinders having a diameter R, the intermediate connection layer has a circular periphery portion having a diameter r, and a spaced distance between the intermediate connection layer and the shield layer is L.

It is respectfully submitted that the Examiner has not made out a prima facie case of obviousness. In the Office Action, it is admitted that the condition $(R \cdot r) / (2 \cdot h) \leq L \leq (5 \cdot R \cdot r) / h$ (which is now recited in the last paragraph of new claim 16) is not taught by Young. In fact, the prior art of record does not teach or suggest that the condition $(R \cdot r) / (2 \cdot h) \leq L \leq (5 \cdot R \cdot r) / h$ is in any way result effective. Where a parameter is not recognized to be result-effective, the optimization of that parameter cannot be obvious. *In re Antonie*, 195 USPQ 6, 8-9 (CCPA 1997).

Moreover, the optimization of the condition $(R \cdot r) / (2 \cdot h) \leq L \leq (5 \cdot R \cdot r) / h$ in combination with the recited structure yields unexpected results including permitting signal connection members to be equal to or more than twice as dense per unit area than in previous devices as was noted above and on pages 2, 16, and 23 of the specification.

The broad language in column 1, lines 39 through 60 of Young cited in the Office Action relates to Young's structure which is substantially different from Applicant's structure and does not constitute a teaching of the above quoted specifically recited relationship of the last paragraph of new claim 16.

In the present invention, the relationship between the connection distance h, the interconnect layers 102 and 112, the diameter R of the substantially cylindrical connections 103, the diameter r of the substantially circular intermediate connection layer 106, and the spaced distance L between the intermediate connection layer 106 and the shield layer 107 permits the higher density of signal connection members.

More specifically, by determining an area for the spaced distance L between the intermediate connection layer 106 and the shield layer 107 on the basis of the connection distance h between the interconnect layers 102 and 112, the diameter R of the substantially cylindrical connection members 103, the diameter r of the substantially circular intermediate connection layer 106, the shape and the positional relationship between the interconnect layers 102 and 112, the connection member 103, the intermediate connection layer 106 and the shield layer 107 are determined. In other words, a value of signal reflectance generated between the connection members 103 and the interconnect layers 102 and 112 is determined, which embodies a concrete structural requirement for obtaining a multi-level circuit substrate having a desired signal reflectance.

Thus the multi-level circuit substrate of the present invention is a unique arrangement in which a substantially circular intermediate connection layer 106 is sandwiched between both connection members 103 and is electrically connected to both connection members 103 and a shield layer 107 provided in approximately the same plane as the intermediate connection layer 106 and surroundingly spaced from and around the intermediate connection layer 106. The signal reflectance of the signal connection members can be set to be of a desired value, and when compared to a conventional arrangement in which not less than 5 grounding connection members are provided for a single signal connection member, it is possible to exhibit the peculiar effect in that it is possible to form signal connection members at a density of twice or more per each unit area.

Accordingly, in the present invention the relational expression $(R \cdot r)/(2 \cdot h) \leq L \leq (5 \cdot R \cdot r) / h$ is not a matter of design that can be adjusted by a person with ordinary skill in the art but is a description of a specific unique structure totally different from the prior art and which provides unique results not found in the prior art.

The derivation of the relational expression is described in great length and complexity on page 11, line 8 through page 19, line 19 of the Specification. Nevertheless, similar language in original claim 1 was improperly dismissed as being "an obvious matter of design choice" with reliance upon *In re Aller*, 105 USPQ 233 and *In re Leshin, 125 USPQ 416*. Both cases involved primary references which were almost identical to the claims at issue. Such is not the case here. More specifically, in *Leshin* the claim differences were the use of a different material from the otherwise identical prior art and the use of a lower temperature different from that disclosed in a prior art process in Allar. The facts in this application are precisely opposite in that the prior art

Young reference discloses structure that is different in may substantial ways from the structure recited in claim 16 and there is a total absence of teaching as to how Young could be modified to anticipate claim 16.

A rejection based on "obvious matter of design choice" as in the Office Action is not proper, where, as here, there is no teaching or suggestion of prior art that would lead one of ordinary skill in the art to modify the structure of the prior art to arrive at anticipation of an applicant's invention. *In re Chu*, 36 USPQ2d 1089, 1095 (Fed. Cir. 1995). Further, a "finding of 'obvious design choice' [is] precluded where, as here, the claimed structure and the function it performs are different from the prior art". Young does not disclose the claim 1 structure as noted above and consequently cannot possibly teach the function provided by such claimed structure.

Moreover, an "obvious matter of design choice" must be based on an explanation why the reference or the general knowledge of the art provides a teaching, suggestion or motivation to modify the teachings of the reference to produce the claimed structure; and in the absence of such a teaching, suggestion or motivation, the rejection must fall. *In re Gal*, 25 USPQ2d 1076, 1079 (Fed. Cir. 1992). Young is totally devoid of any such teaching.

The limitations of the condition and the claimed structure in question are clearly disclosed in the appellants' specification as solving the particular problems discussed on page 2 and as explained on page 3 of this application. As such, these claim limitations may not properly be dismissed as obvious matters of design choice without supporting evidence.

It is therefore urged that a rejection of new claim 16 relying upon the "obvious matter of design choice" rational employed in Section 9 of the last Office Action in rejection of claim 1 would be manifestly improper.

Additionally, neither Young (U.S. Patent No. 5,408,053) and Hayashi (U.S. Patent No. 5,406,235) discloses or suggests the arrangement peculiar to the present invention. Namely, the employment of a substantially circular intermediate connection layer 106 sandwiched between both connection members 103 and electrically connected to both connection members 103 and a shield layer 107 provided in approximately the same plane as the intermediate connection layer 106 and surroundingly spaced from and around the intermediate connection layer 106.

Clearly, the aforementioned shortcomings of Young are not taught or suggested by the Hayashi U.S. Patent No. 5,406,235, which is directed to a totally different device from that of either Young or the present application.

It is respectfully submitted for the above reasons that new claim 16 should be allowed.

Claim 17 depends from claim 16 and should be allowed for the reasons stated above with respect to claim 16. Moreover, claim 17 further distinguishes over the prior art in reciting that the insulation comprises first, second, third and fourth insulation layers stacked over each other with the shield layer being sandwiched between the second and third insulation layers and wherein the conductors comprise a lower conductor electrically connecting the lower interconnect layer and the intermediate connection layer and an upper conductor electrically connecting the intermediate connection layer to the upper interconnect layer.

Claim 18 depends from claim 16 and should be allowed for the same reasons as discussed above with respect to claim 16. Moreover, claim 18 further distinguishes over the prior art in specifying that the shield layer is a ground layer.

Claim 19 depends from claim 16 and should be allowed for the same reasons as discussed above with respect to claim 16. Additionally, claim 19 further distinguishes over the prior art in specifying that the shield layer is a power source layer.

Claim 20 depends from claim 16 and should be allowed for the same reasons as discussed above with respect to claim 16. Moreover, claim 20 further distinguishes over the prior art in specifying that the multi-level circuit substrate transmits a signal having a wave length shorter than 1,500 times the connection distance h.

Claim 21 distinguishes over the prior art in reciting the combination of upper and lower interconnect layers separated by first insulator in combination with upper and lower conductors respectively contacting with the upper interconnect layer and the lower interconnect layer with an intermediate connection layer being sandwiched between and contacting the upper and lower conductors so as to complete a connection between the interconnect layers. Moreover, claim 21 further provides for a shield layer provided and in alignment with and surrounding the intermediate connection layer but spaced therefrom by a gap in which a second insulator having a lower specific dielectric constant than the first insulator is positioned. The prior art is devoid of the aforementioned relationship and does not suggest the claimed combination set forth in claim 21. It is therefore respectfully urged that claim 21 should be allowed.

Claim 22 depends from claim 21 and should be allowed for the same reasons as discussed above with respect to claim 21. Moreover, claim 22 further distinguishes over the prior art in recitation of the following condition or relational expression, which reads:

> wherein a condition of $(R \bullet r \bullet \sqrt{\varepsilon'}) / (2 \bullet h \bullet \sqrt{\varepsilon}) \leq L \leq (5 \bullet R \bullet r \bullet \sqrt{\varepsilon'}) / (h \bullet \sqrt{\varepsilon})$ is satisfied, provided that a connection distance between the interconnect layers through the aligned conductors and the intermediate connection layer is h, the aligned conductors are circular cylinders having a diameter R, the intermediate connection layer has a circular periphery portion having a diameter r, and a spaced distance between the intermediate connection layer and the shield layer is L.

The preceding discussion of the condition or relational expression recited in claim 16 is equally applicable to the above quoted condition of claim 22 and reference is made thereto.

Claim 23 is dependent from claim 21 and should be allowed for the same reasons as claim 21 as discussed above. Claim 23 further distinguishes over the prior art in adding the intermediate connection layer and the shield layer which are sandwiched between the lower insulation layer and the upper insulation layer and the provision that the connection number is comprised of a lower connection number provided in contact with the lower interconnect layer and the intermediate connection layer. Additionally, further distinction over the prior art is provided by the recitation of the upper connection member provided in the upper insulation layer and electrically connecting the upper interconnect layer and the intermediate connection layer.

Claim 24 depends from claim 21 and should be allowed for the same reasons as claim 21 as discussed above. Moreover, claim 24 further distinguishes over the prior art in indicting that the shield layer is a ground layer.

Claim 25 depends from claim 21 and should be allowed for the same reasons as claim 21 as discussed above. Additionally, further distinction of claim 25 over the prior art is provided by the limitation that the shield layer is a power source layer.

Claim 26 depends from claim 21 and should be allowed for the same reasons as claim 21 as discussed above. Additional distinction is provided by the limitation that the multi-level circuit substrate transmits a signal having a wave length shorter than 1,500 times the connection distance between the interconnect layers through the upper and lower conductors and the intermediate connection layer.

Claim 27 distinguishes over the prior art for the same reasons as recited claim 16 as discussed above. Additionally, claim 27 further distinguishes over the prior art in reciting that the intermediate connection layer has a circular peripheral surface.

Claim 28 depends from claim 27 and should be allowed for the same reasons as claim 27 as discussed above. Additionally, claim 28 further distinguishes over the prior art in reciting that the end termination of the upper interconnect layer and the lower interconnect layer each include a connection land that is generally circular in plan and position to contact a respective one of the aligned conductors and has parallel side edges.

Claim 29 distinguishes over the prior art for the same reasons as is parent claim 27 that is discussed above. Further, distinction over the prior art is provided by the recitation that the shield layer has a circular cut-out defined by a circular surface spaced from and surrounding the intermediate connection layer.

Claim 30 is similar to new claim 16 while additionally including the recitation of connection lands which are connected to the non-aligned interconnect layers which are connected to the connection lands. Additionally, claim 30 in the last paragraph includes the condition recited in the last paragraph as in new claim 16. Therefore, the comments made above with respect to claim 16 in support of the patentability of that claim are equally applicable to new claim 30 and new claim 30 should therefore be allowed.

Claim 31 depends from claim 30 and should be allowed for the same reasons as claim 30 as discussed above. Additionally, claim 31 further distinguishes over the prior art in reciting that the insulation comprises first, second, third and fourth insulation layers stacked over each other with the shield layer being sandwiched between the second and third insulation layers and wherein the conductors comprise a lower conductor electrically connecting the lower inner connect layer and the intermediate connection layer and an upper conductor electrically connecting the intermediate connection layer to the upper interconnect layer.

Claim 32 depends from claim 30 and should be allowed for the same reasons as claim 30 as discussed above. Additionally, claim 32 further distinguishes over the prior art in specifying that the shield layer is a ground layer.

Claim 33 depends from claim 30 and should be allowed for the same reasons as claim 30 as discussed above. Moreover, claim 33 further distinguishes over the prior art by the recitation that the shield layer is a power source layer.

Claim 34 depends from claim 30 and should be allowed for the same reasons as claim 30 as discussed above. Additionally, claim 34 further distinguishes over the prior art in specifying that the multi-level circuit substrate transfers a signal having a wave length shorter than 1,500 times the connection distance h.

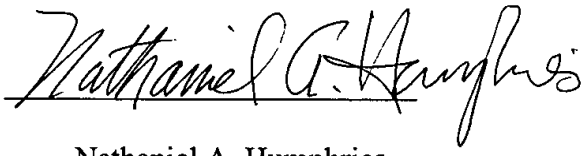
CONCLUSION

All objections, rejections, and requirements have been complied with, properly traversed, or rendered moot. Thus, the application is in condition for allowance. Should any questions arise, the Examiner is invited to call the undersigned representative so that this case may receive an early Notice of Allowance.

Favorable consideration and allowance are earnestly solicited.

Respectfully submitted,

JACOBSON HOLMAN PLLC

Date: 19 November 2003 By: 

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